REPORT

OF THE

MAIN DRAINAGE COMMITTEE

TO THE

CITIZENS' ASSOCIATION

OF CHICAGO.

DECEMBER, 1880.

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HAZLITT & REED, PRINTERS, 172 AND 174 CLARK STREET.
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EXECUTIVE COMMITTEE, 1880-81.

EDSON KEITH, *President*,
A. A. CARPENTER, *Vice-President*,
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MARSHALL FIELD,
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GEORGE SCHNEIDER,
Treasurer.

J. C. AMBLER,
Secretary.

ROOMS, 35 MERCHANTS' BUILDING.

TO THE EXECUTIVE COMMITTEE

OF THE

CITIZENS' ASSOCIATION OF CHICAGO.

The Committee to whom was referred the subject of "Main Drainage," with a view of recommending some system for the disposition of the sewage, adapted to the present and future needs of Chicago, respectfully submit the following Report:

You are aware that there was some hesitancy and delay in forming this Committee, consequent partly, on the delicacy inseparable from the fact that the importance of the subject is such, that any recommendation of a very positive character, particularly if it conflicts materially with general opinions and is calculated to disturb existing systems, must be the subject of extended criticism, unfavorable and otherwise, by all classes of intelligent citizens, professional, administrative and financial; and partly because it was believed that more time would be required for its full consideration than the Committee could devote to it, within the period when you would wish to give it to the public. Relying on your assur-

ances that the latter should be regulated to suit the circumstances, and availing ourselves of the competent engineering and clerical assistance furnished to us, we proceeded with the investigation necessary to comply with the terms of the letter of request on which the Committee was formed.

The importance of the question submitted to us requires no emphasis; it has been a great one, ever since our city inaugurated the existing system of sewerage, and it has become of vital interest within the last few years; it is now deemed paramount, particularly in its sanitary bearings, by all those who have given intelligent attention to the subject. It has been the topic of active discussion for a long period, and its interest seems to have culminated at the present time. It has called forth unnumbered and some very able communications through the press, has been the theme of

SCIENTIFIC DEBATE,

and the prolific source of speculative propositions for for its solution; municipal authorities have shrunk from the task of grappling with it, and legislators have recoiled from its consideration on account of its appalling magnitude. The policy heretofore pursued in regard to this great question may be justly called a temporizing one in the most extended sense of that term, for all plans heretofore adopted have confessedly been of a temporary character, and the ultimate solution of the problem has been, with great unanimity, deferred to some future and indefinite time. But present emergencies seem to urge forward opinion in the direction of a final and decisive consideration of it, which as your letter remarks, "has not been undertaken a moment too soon."

After fully considering the best mode of procedure, we concluded that for the purpose of eliciting the opinions of those who desired to state their views or to submit plans, we would invite communications and call public meetings, where the whole subject would be open to discussion and where useful hints or facts might be elicited by interrogatories made at the moment, and by bringing together parties who had information to impart or who desired to substantiate or correct preconceived notions. The plan was eminently successful; the meetings were well attended and very interesting to all who participated in them, particularly to our Committee, who were thus enabled to collate and compare the ideas expressed, and to correct erroneous or imperfect impressions in regard to this absorbing question. Some new facts were presented and their bearing on the subject was duly considered. Communications sent to us, in accordance with our invitations, were treated in the same way, by analysis and comparison. A meeting of Civil Engineers for discussion of the same topic was also well attended, and included the members of this Committee and many citizens and officials. It is from these sources and inquiries pursued privately, that we submit the following account of the position, which we have made as brief as possible, and which, though most of it is already familiar to the public, we deem necessary to the symmetry of our report. For the sake of brevity, we shall make no particular account of figures, but confine ourselves to the general view of the subject, supplemented by a proposed plan at the close.

THE TOPOGRAPHICAL SITUATION

of the drainage district under consideration may be briefly described as a strip of land, in the eastern part of Cook County, varying in width from 7 to 10 miles,

traversed by the Chicago River its whole length, which is about 40 miles; the only outlet of this River to the Lake is at the point where the City of Chicago stands, about 35 miles south of the source of the River, and 5 miles north of the southernmost of its branches or forks; the outlet to the Lake at Chicago has been widened and deepened and its course changed so that it opens nearly due east, is called the main branch of the Chicago River, and is at right angles to the principal streams which are called respectively the North and South Branches. These branches have also been widened and deepened to meet the necessary requirements of commercial enterprise, so that vessels of from 10 to 14 feet draft can navigate with safety the River and its branches, to a distance one mile west from the entrance and six miles north and south, all within the city. The process of enlarging the River, at Chicago, has destroyed what little natural current there ever was in it, and there is now no other than that caused by winds, the inflow of water from the lake, or a freshet caused by extraordinary rain fall or the melting of snow and ice in the spring. For the purposes of this Report the Chicago River may be described as a great ditch 6 miles long, with a projection from about the centre 1 mile long, and the whole averaging about 150 feet in width and 10 to 15 feet deep; this ditch receives at its north end a small stream, (30 miles in length), the force of whose feeble current is neutralized by the increased width and depth of the channel it enters, and it has at its south end several forks or branches which serve to take off a small amount of water; there is also, from the South end, the Illinois and Michigan Canal, to which reference will be made hereafter. Into this huge ditch the greater part of the sewage and other drainage of the City of Chicago falls, together with the offal of the immense slaughtering establishments, situated in the adjoining Town of Lake, the refuse of the manufactories great and small, and to far too great an extent, that of the distilleries and their adjoining cattle pens. A part of the sewerage system

has its outlet directly into the lake in front of the city, but that part is by comparison so small as to have no bearing on the main question before us, at this point of its consideration. The whole geographical position is backed on the West by a ridge, which though of no great elevation, is sufficient to form a water shed of the greatest length given above, with the river running through it about equi-distant from the ridge and Lake Michigan; the land between the ridge and the lake traversed by the river is flat, and just where the city stands, is a little higher on the West bank of the river than on its East side, towards the lake; the natural flow of water from all points is towards the River and not to the Lake.

THE ONLY NATURAL MEANS

of flushing or scouring out this great ditch, is from the water during rains, which flows into it from the adjoining country, including that part bordering the northern projection, the freshet caused by the melting of snow and ice in the spring, and the overflow of the Des Plaines River, which sometimes swells over the low ridge referred to above, and comes in great and often destructive volume into the South Branch and so through the Main Branch of the Chicago River into the lake. Could this be relied on at all times, it might be so utilized as to relieve the drainage difficulty now before us, although it would necessitate some other plan than that we have adopted for our water supply for domestic and all other purposes; it is, however, unfrequent and undesirable.

The obvious consequence of this state of affairs is that at all times since the city adopted a system of sewerage, the River has been befouled with its discharges and

accretions, for which there have been no natural remedies except those of the occasional character mentioned above. As the population increased this befoulment became more marked, and in time so unendurable that relief of some kind became imperatively necessary, as, although the pumping works at Bridgeport, originally erected in 1847 for the purpose of supplying water to the Illinois and Michigan Canal had been utilized for the purpose of cleansing the River to the extent of their capacity, that system was found to be very inadequate for the object, and after five years work

THE CANAL

was widened and deepened so that in 1871 it was opened for the inflow of the Chicago River, amidst public rejoicings, and there was a sanguine belief that our drainage troubles were at an end. It was soon found that these anticipations were doomed to disappointment; the depth of the canal after enlargement is about eight feet less than that of the River, and the sides were cut down at an unfortunate angle, making them too steep or upright; the consequence has been that the water flowing from the lake to the canal, through the river, has only cleansed that portion of the last which was five feet above the bottom, there being a recoil at the mitre sill of the canal, of the water below it, and a backward current of greater or less power according to circumstances; besides this, the canal began gradually to fill up from the sediment carried into it from the river, and from the deposits naturally coming over the sides, thus decreasing the depth and the capacity for taking water from the River; at about this time, (1871,) also, the Lake began to fall, as it is known to do at periods, diminishing the volume of water in the River. The net result of all these causes was soon apparent. It

was seen that by deepening the canal we had only lengthened the ditch which we call the Chicago River, and that after the canal had been filled, it was, with such relief only as is obtained by opening the locks for the passage of vessels or other purposes, fast becoming as foul as the river itself, to the unmitigated annoyance of the inhabitants along its line; and it was the subject of their loud protests. Nothing can keep it even moderately clean but constant dredging, rendered more expensive from the very fact that it has been deepened.

Some other means of cleansing the River was demanded, and the

FULLERTON AVENUE CONDUIT

was projected, to scour the river by pumping from the Lake, or, *vice versa*, to create a current through the main River, up the North Branch, and so out into the Lake, flushing the South Branch as a collateral measure by the natural process of displacement or suction which would follow.

It were profitless to attempt to detail the various annoyances the public have been subjected to during these many years they have been waiting for some plan of relief for their sufferings from the foul condition of their principal sewer, which unfortunately for the purposes of drainage, is also a navigable river; an overflow of the Des Plaines or a freshet from any cause has been hailed with something akin to delight, and a easterly storm by driving in the water to dilute and carry off part of the filth has been looked upon as a blessing.

We have arrived, in this report, at that period of time, (February and March, 1880,) when, while the Fuller-

ton Avenue Conduit is in full and partly successful operation, the public meetings referred to above were held with the view of a free discussion of the whole subject.

In addition to the facts hereinbefore stated, some others having a very imporant bearing on this question were brought to light, the principal one being that which relates to the operation of the Fullerton Avenue Conduit, which had at that time been sufficiently tried in one direction, that of sending water from the Lake into the River, and so out by the Main Branch into the Lake again, to develop the danger there would at all times be of fouling the water supply for domestic purposes; the experiments made for the purpose of ascertaining such a probability, demonstrated conclusively that a very considerable quantity of the filth discharged from the mouth of the river found its way back into the water pipes, and further investigation has shown that except under favorable conditions this will always be the case, as the contents of the river will not, all of them, mingle immediately with pure water, and be carried away by any current that may be caused by winds, favorable for the purpose, but for a long time will float about the lake in a semi-isolated mass, subject to the effect of such winds and currents as may strike them, and always liable to run into the tunnel at the crib; and for this reason, that there is always there an effective current for a considerable distance in every direction, around and tending towards the Crib. It was shown also, that temporary relief could be obtained by the immediate re-erection of the pumping works at Bridgeport, and it is believed that with the aid of the Fullerton Avenue Conduit, these pumping works at the entrance of the Canal will afford such a measure of relief as will enable the city to get along with moderate annoyance for five years or so, or until some better system has been brought into operation. The immediate re-erection of those pumps was, therefore, the recommendation

made by our Committee, through you, to the municipal authorities, as a temporary expedient, and the money having been appropriated by the Council for the purpose, the action of the City Executive is awaited with becoming patience.

Review the topographical situation as hereinbefore given, revise the meagre history of the attempts to purify the River, consider the feeble means now in operation and those necessarily temporary adjuncts looked for at an early date, and to these considerations add the probability that the drainage district we have contemplated is to be the home of 2,500,000 people within the period of existence of many now living, and you have before you the drainage problem as we understand it.

It should in justice be said that any attempts heretofore made to relieve the difficulties which are under consideration have necessarily been of a temporary or make-shift character, and that this has been the outcome of a want of sufficient means to carry out comprehensive plans for this or any other great public improvement; and besides, the unparalleled growth of Chicago has set at naught the calculations of its most sanguine municipal administrators, and in nothing more than in this drainage question; the manufactories and packing houses alone, which turn their *debris* into the River, exceeding in their magnitude all suggestions of but a few years since.

Since the date alluded to above, (February and March, 1880), the history of this subject can be briefly sketched and is of interest. The machinery of the Fullerton Avenue Conduit has been reversed and the river water has been continuously pumped towards the lake, while during the same time there has been one of those periodical phenomena called a "rise of the lake", an occurrence which takes place about once in seven years and has always been followed by a corresponding

recedence, gradual in its character, until the lowest point is reached. The effect of these two causes has been to give parts of the river an appearance of cleanliness, as the fresh water over-rides the filth, while the action of

is continually drawing off the latter from the North Branch, while at the same time the rise of the river and recent dredging of the Canal has opened a passage in that direction which takes off a part from the South Branch; what drainage matter does not pass off in this way remains covered over by the clear water and gradually works it way in a feeble under current towards the mouth of the river and the lake, or backed up into the sewers, is reflected in those nauseous vapors which have so much disturbed the inhabitants of the North and South Divisions, and in a less degree those in the West Division, during the last summer. There can be no doubt that if the pumps into the Canal were now in position and operation, the combined action of the three powers mentioned above, would give us as clear a river as it is possible for us to get with our present resources.

It is believed that the canal has the capacity for taking all the water that it would be desirable to pump into it, and that if the proposed pumping works were so constructed, with a trap wall, so as to take the water from the bottom or lower part of the river, there would be a decided improvement in drawing off some of the heavier matter.

It now becomes our duty to consider the numerous and various plans presented to us for the final and decisive

presented; and in doing so we have only to regret that many ingenious suggestions have to be passed over with the general remark that in our judgement they are not adapted to application on such a gigantic scale as that which is presented to our view of the situation; in smaller constituencies they would find a better field of usefulness. The first of feasable propositions that presents itself, has the endorsement of such high authority, that of itself it is entitled to the primary consideration which we give it: it is, to erect works of a similar character to the Fullerton Avenue Conduit at the southernmost end of the South Branch, and by the process now in practice, to pump the water either from the Lake into the River, or flush the River by reversing that process and allowing the water to pass through the main channel and by the North and South branches into the conduits and so into the Lake. That this would be effective for a district circumscribed in extent is quite apparent, but that it would not be a solution of the great problem is also so apparent that it is only necessary to refer to the fact that it makes no provision for any afflux of ingredients beyond the narrow bounderies of its *termini;* this scheme appears to us local and narrow in its general characteristics, and unworthy of consideration in a general sense. It is embarrassed, also, with the general objections expressed below, with regard to the expense of pumping operations, and of the discharge of filth into the lake.

Another, and by all means in our view, the most feasable and proper mode for ridding ourselves of the difficulty growing out of the drainage question, excepting that which we shall ultimately present, is that of an

which, traversing the river bank on both sides shall deliver the city sewage at some point where it can, by the application of power, be discharged somewhere, either into the Lake, or upon land selected for the purpose, of sufficient extent to absorb the issue for a term of years. The advantages of a syphon principle as applied to such a plan are not sufficiently apparent to warrant more than a general reference to them.

Another project is to allow all the water of the drainage district above the city limits, to traverse a canal constructed for the purpose, in the rear of the city, supplemented by the Fullerton Avenue Conduit, and to turn all the sewers west of the river into that canal, which would find its outlet into the Des Plaines River; the sewers in the South and North divisions of the city, to be discharged into the Lake.

The embarrassments referred to above as a general objection to any one or all of the plans presented to us are that they involve continual and increasing expenditures for their successful operation, in the way of pumping or other mechanical appliances, and that, even when successfully prosecuted, their effects are local. But the most objectionable feature of all is, that the ultimate disposition of the sewage is towards the Lake.

In the plan which we shall hereafter present the objections to an intercepting sewer, growing out of the expense of pumping or final disposition of the sewage are overcome.

Our objections to any plan which suggests the discharge of sewage or other impure matter into the Lake,

where they could in any event contaminate the water supply, are so fixed, that part of the recommendation in the plan we shall hereafter propose, is, that a radical change in the whole system of sewerage in the North and South divisions shall be inaugurated, by which all sewers shall empty into the River, and although we have given careful consideration to all plans laid before us, we make no reference to any, except those mentioned above, which propose the use of the lake for the ultimate disposition of the sewage. Just here it is proper to remark, that the filthy water flowing from the Fullerton Avenue Conduit, when it is operated in the direction of the Lake, is traceable for a long distance out towards the crib, unless a strong wind carries it along the shore. Any attempt to remedy this by extending

further out to the eastward, would, in our judgment be futile, and suggestions for carrying the pumping works for the water supply northward, to some distant location on the Lake Shore, besides being a partial remedy only, would be attended with a much greater expense than what we consider a more feasable plan would cost.

It has also been suggested to us, that if the locks and dams in the Illinois and Michigan Canal were removed, the water would flow freely through the canal and so cleanse the river; but to this it is answered, that such a course would destroy the usefulness of the canal for purposes of navigation, interfere with many private rights, and require that the canal should be deepened to the depth of the river, at a very large expense, which can be utilized for another project unobjectionable in any of its other features.

We wish to remark, before proceeding to another branch of the subject, and in reply to a suggestion, that while the proposed pumping works at Bridgeport are in operation, the water should be shut off from the North Branch, or that gates at the forks of the River should be used; that, in our judgement, would not be necessary, as we have competent authority for the opinion that the waters forced down the North Branch by the Fullerton Avenue pumps, would mingle with that coming in from the lake, and take a southerly direction towards the works at the canal.

Alternative propositions have presented themselves to our minds, for the final solution of this great problem; the one which at first seems most plausible, partly because it follows in the direction of public opinion, as at present pointed, is that of a Ship Canal, the suggestions for which embody plans for the construcion of one of great dimensions, into which it is proposed to drain Chicago City, and the district we have hereinbefore described. We have given a large share of our attention to this scheme, and although we are unanimously and cordially in favor of a ship canal as such, we cannot give it the sanction of our favorable opinion as a drain; as such it would be liable to all the objections now urged against the present canal, as to its annoyance of the inhabitants along its banks, for the reason that any current which would move the water with sufficient velocity to prevent the deposit of filth, would impair its usefulness for commercial purposes, it having been well ascertained, that no current greater than half a mile per hour is tolerable in slack water navigation. The project for the construction of such a canal, is embarrassed, also, with many considerations of a political nature, which we do not deem it within our province to consider, preferring to present the other plan, which can be carried out within a reasonable time, at a very moderate cost, and which is wholly within the scope of the pecuniary means of those for whose benefit it will

have been constructed, and will, it is believed, be wholly devoid of offence to any locality or people.

We present to you and the public a proposition or plan for an independent cut for the drainage of the district to which we have heretofore alluded, the details of which are embodied in the following report, from the well known and competent engineer whose name it bears, whose services you placed at our disposal, for the purpose of making the estimates, and drawing the map and profile accompanying it, reduced copies of which we append hereto, and the originals of which are on exhibition at your rooms in this city, for inspection of the public.

Such is the plan proposed for the drainage of Chicago, which, it is believed, will accomplish the object desired for all time to come.

To complete it, however, the sewers discharging into the Lake will have to be reversed, and made to empty into the river, as also, the local drains in the adjoining towns north of the city, as far as the source of the Chicago River, and those of Hyde Park. The towns of Lake and Cicero will also come within the drainage district herein proposed. In reversing the city sewers, such a fall should be made as would carry the lake water through them, thus cleansing and rendering them inoffensive at all times. The Fullerton Avenue Conduit could remain as it is, or its tunnel could be utilized for additional water supply. An intercepting sewer can be built if needed.

The forks and branches of the River at the south end of it will purify themselves, as their contents will gravitate towards the current created by the outflow of water to the cut or New River, as it may be called for the purpose of description. The current in this New River will be at the rate of about $2\frac{15}{100}$ miles per hour; the water

in Chicago River will be changed every 24 hours, with one million of cubic feet over, and the whole body of it within the city limits, will be by this operation, become as clear as that of the lake; the effect upon the waters at its point of discharge, will be to greatly improve them in every respect.

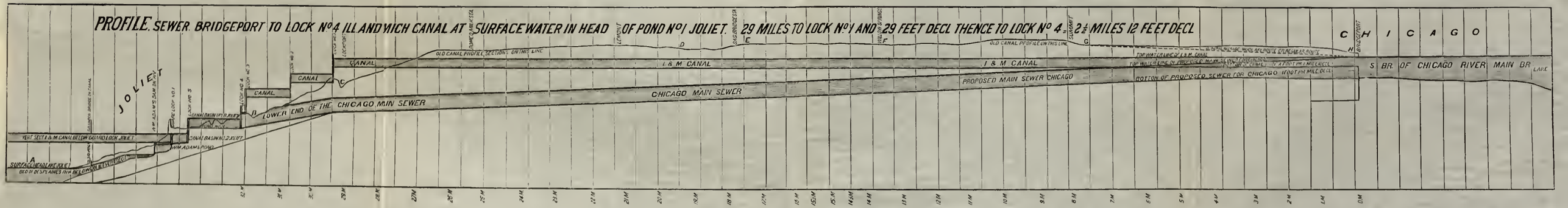
To carry into effect such a project, so vast and so important, some legislation will probably be necessary, to extend the provisions of the present drainage law, so as to create a drainage district and a commission for the purpose. The estimated cost of the New River is $6,850,000, but to complete the project in every respect, the sum of $12,000,000 will probably be necessary. The Commissioners who may have charge of the operation, should be empowered to borrow the money for the purpose, on the credit of the district benefited and incorporated by law, and such a loan would probably, if redeemable in 30 years or more, be readily taken at four per cent. Even at a low assessed valuation of property, a tax of two mills would be amply sufficient to pay the interest and provide a sinking fund for the principal. As projects for the storage of water in the upper Mississippi district, and about the sources of the Missouri and Rock Rivers, for the purpose of supplying those streams in seasons of drought or low stages, have been before Congress, it is probable that such a plan as this, would meet with equal favor there for a similar purpose.

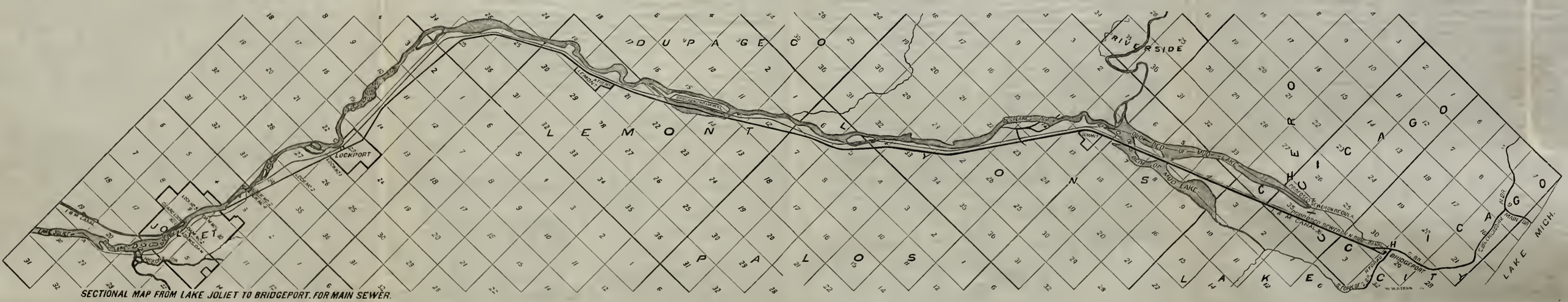
Respectfully Submitted,

JOHN B. SHERMAN,
GEO. C. MORGAN,
S. B. REED.

Committee on Main Drainage.

CHICAGO MAIN SEWER
I.& M. CANAL





SECTIONAL MAP FROM LAKE JOLIET TO BRIDGEPORT. FOR MAIN SEWER.

J. C. AMBLER, Esq.

Secretary Citizens' Association,
Room 35, Merchants' Building, N. W. Cor.
La Salle and Washington Streets, Chicago.

DEAR SIR:

On the 11th day of June, A. D. 1880, a telegram was received from you, asking for a consultation with me at your office or rooms, on the 12th, in regard to the drainage of the City of Chicago.

On that day I met you and others, for the purpose proposed, and after a free exchange of views, received an order from you, as Secretary of the Citizens' Association, to prepare a map and profile, with approximate estimates of cost, for a sewer for such drainage, with limit of time to 12th day of September following.

Herewith I hand you a map, drawn from the U. S. Government surveys, and from my own surveys of the Illinois and Michigan Canal, which were executed in behalf of the State of Illinois.

On this map, marked A, B, C, D, E, F, G, H, in red ink, will be noted a line in heavy red ink, from the mouth of the *Regula* or Mud Lake fork of the South Branch of the Chicago River, running off west, and through said Lake, toward the DesPlaines River, north of summit, and then curving round to the left, keeping away to the left, and passing along in a southwest direction between the Canal and River, past the ice houses, and between said houses and the River, to Mount Forest, Willow Spring, Sag Bridge Station, and Lemont, to the Romeo bend of the Canal, Norton's Tail Race at Lockport, and to a point opposite Lock No. 1, at Lockport. Thence to a point at the head of the pond of Dam No. 1, Joliet, a few hundred feet northwest of Lock No. 4, of the I. & M. Canal, a distance not far from 31½ miles.

While conversing with you on this subject, it was stated, that where the levels were not satisfactory to me, as to points on the DesPlaines below Joliet, new levels should be taken, and a profile thereof made.

A corps of engineers was set at work from Norton's tail race at Lockport, to a point on Lake Joliet, a distance of about seven miles, the result of which survey and levels you will see on the map and profile, marked A, B, C.

After carefully looking over the excavation to be done, on a line extending the sewer below Lock No. 4; costing in the aggregate about $613,000, with no adequate compensation, it was apparent that the sewer proposed, should terminate near said Lock No. 4 at B, *see map and profile.*

Then, commencing for the south-western terminus of the sewer at B, and running on the red line about 2½ miles N. N. E., we reach a point opposite Lock No. 1, with a fall to the south of about 12 feet in bottom of sewer, or $4\frac{80}{100}$ feet fall per mile, and the average width of 15 feet.

Then run north and north-east upon the red line, past Romeo and Lemont, Sag Bridge Station, Willow Springs, Mount Forest, Summit and Mud Lake, or regular route, we touch Bridgeport, a distance from Lock No. 1, of 29 miles, and an ascent of 1 foot per mile, making 29 feet fall from Bridgeport to Lockport, in bottom of sewer, with a width of sewer at lower end, of *20 feet*, and at upper end, of *49 feet*, for compensation.

This route, as will appear by the red ink line on the map, lies north and west of, and entirely away from, the Illinois and Michigan Canal and its right of way.

Where deemed necessary, the bottom of the sewer shall have an inverted arch of long pave, and the sides thereof, to a point 14 feet above bottom, should be lined by a good, firm, retaining wall.

Good substantial abutments and bridges at all crossings will be necessary throughout, and at Big Run—Norton's tail race and Fraction Run; an arch about 300 feet long, in each, will be needed to let the water from these several places, pass over the top of the sewer.

The eastern portion of this route is already excavated to about the proper width, but *not* to the proper depth.

The sewer when completed should draw water from the surface to the bottom of the River, low water, datum line, for the first 29 miles, making a "*wet line*" as shown on the profile, and draw to bottom of River at H, as per profile.

A portion of West Chicago, and the Town of Cicero, under an arrangement with the city, may drain *directly* into the main sewer.

The amount of excavation for the above sewer, by a carefnl approximate estimate will be 3,031, 285,00 cubic yards.

COST OF EXCAVATION.—Earth and rock—slope wall—inverted arch in bottom and the three arches aforesaid	$6,365,698.00
Contingencies, Engineering, etc.	483,625.00
Total cost	$6,849,323.00

Having set forth the cubic yards to be excavated in the above sewer, including earth and rock, with the probable cost, I will proceed to state the cubic feet of water which the sewer is expected to pass, at a point opposite Lock No. 1, with a clear width of 20 feet, a depth of 10 feet, a fall of 1 foot per mile, and a *width* at upper end of sewer of 49 feet, and widening from Lock 1 to head of sewer, at the rate of 1 foot per mile, as compensation; with this area of flow of water, say 10 ft. x 20 ft., making a "wet line" of 40 feet, we have reason to expect a discharge of 632½ cubic feet of water per second; 37,947 cubic feet in a minute; 2,276,820 cubic feet in an hour, and in 24 hours, 54,643,680 cubic feet.

In seven miles length of Chicago River, I have estimated 53,734,080 cubic feet of water, from the data furnished me, and hence we deduce it as a theoretical fact, that the sewer will discharge the entire amount of water in the Chicago River in 24 hours, and *then* draw about 1,000,000 cubic feet of clear Lake water through the sewer beside. But as theory is sometimes doubted as against practical experience, we can afford to assume, with the light we have, that in twenty-four hours we can drain the Chicago River.

I have, as already mentioned, run new levels and a transit line for about seven miles of the distance, and have given the general subject as much time for investigation as was practicable, unless I had been ordered to make a careful survey the entire distance.

As approximate estimates of excavation, I consider them reliable, and have attempted to keep within the limit of error in my calculation of the flow of water through this long passage from Lake Michigan to the Des Plaines River.

All of which is respectfully submitted.

Dated at Joliet, this 3d day of September, 1880.

A. J. MATHEWSON.